

10/088842

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith are being deposited with the United States Postal Service on this date shown below in an envelope as "Express Mail Post Office to Addressee" under the below indicated Mailing Label Number, addressed to: Box PCT, Assistant Commissioner for Patents, Washington, D.C. 20231.

Mailing Label No.: EF232848059US

Deposit Date: March 21, 2001

Marian E. Vasquez  
Name: Marian E. Vasquez

ATTORNEY'S DOCKET NO. DYOUP0227US

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
(DO/EO/US)**

In re national phase of:

Applicant(s): Giovanni Battista Zenga  
International Application No.: PCT/IB00/01419  
International Filing Date: 22 September 2000  
Priority Date Claimed: 22 September 1999  
Title of Invention: LAMINAR STRUCTURE

**TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED  
OFFICE (DO/EO/US) CONCERNING ENTRY INTO U.S. NATIONAL  
PHASE UNDER 35 U.S.C. 371**

Box PCT  
Assistant Commissioner for Patents  
Washington D.C. 20231

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information under 35 U.S.C. 371:

1. This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).
2. The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 CFR 1.492) as indicated below.

3. A copy of the International application (35 U.S.C. 371(c)(2)):
- a. ☒ is transmitted herewith  
(International Publication No. WO 01/21282 ).
  - b. ☐ is not required, as the application was filed with the United States Receiving Office.
  - c. ☐ has been transmitted by the International Bureau. A copy of Form PCT/1B/308 is enclosed.
4. ☐ A translation of the International application into the English language (35 U.S.C. 371(c)(2)) is transmitted herewith.
5. Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):
- a. ☐ are transmitted herewith.
  - b. ☐ have been transmitted by the International Bureau.
6. ☐ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)) is transmitted herewith.
7. A copy of the international examination report (PCT/IPEA/409)
- a. ☒ is transmitted herewith.
  - b. ☐ is not required as the United States Patent and Trademark Office was the IPEA.
8. Annex(es) to the international preliminary examination report
- a. ☒ is/are transmitted herewith.
  - b. ☐ is not required as the United States Patent and Trademark Office was the IPEA.
9. ☐ A translation of the annexes to the international preliminary examination report is transmitted herewith.

10. ☐ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115 is submitted herewith.
11. An International Search Report (PCT/ISA/210)
- a. ☒ is transmitted herewith.
- b. ☐ has been transmitted by the International Bureau.
- c. ☐ is not required, as the application was searched by the United States International Searching Authority.
12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 is transmitted herewith, along with Form PTO-1449 and copies of citations listed.
13. ☐ An assignment document is transmitted herewith for recording, along with a separate cover sheet.
14. ☒ A preliminary amendment is enclosed.
15. ☐ A verified statement claiming small entity status is enclosed.
16. ☐ Other:

## Transmittal Letter to United States Designated/Elected Office

Basic National Fee					Fee
IPEA - US					\$710.00
ISA - US					\$740.00
PTO not ISA or IPEA					\$1,040.00
Claims meet PCT Art. 33(1)-(4) - IPEA - US					\$100.00
Filing with EPO or JPO search report					\$890.00
Enter appropriate basic fee →					\$890.00
Claims*	Number filed		Number extra	Rate	
Total claims	15	-20	0	\$18.00	\$0.00
Independent claims	1	-3	0	\$84.00	\$0.00
Multiple dependent claims (if applicable)				\$280.00	
Total of above					\$890.00
Small entity statement enclosed, 1 if Yes, 0 if No →				0	\$0.00
Total national fee					\$890.00
Fee for recording enclosed assignment				\$40.00	
Total fees enclosed					\$890.00

\*After any attached preliminary amendment reducing the number of claims and/or deleting multiple dependencies.

☒ [X] A check in the amount of \$ 890.00 to cover the above fees is enclosed.

☐ [ ] Please charge our Deposit Account No. 18-0988 in the amount of \$\_\_\_\_\_. A duplicate copy of this sheet is enclosed.

WARNING: TO AVOID ABANDONMENT OF THE APPLICATION THE BASIC NATIONAL FEE MUST BE PAID WITHIN THE 20/30 MONTH TIME LIMIT.

10088842 10/088842

JC10 Rec'd PCT/PTO 21 MAR 2002

Transmittal Letter to United States Designated/Elected Office

Page 5

16. The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to our Deposit Account No. 18-0988:

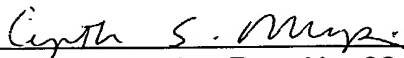
a. ☒ 37 CFR 1.492(a)(1), (2), (3), (4) and (5) (filing fees)

WARNING: BECAUSE FAILURE TO PAY THE NATIONAL FEE WITHIN 30 MONTHS WITHOUT EXTENSION (37 CFR S 1.495(B)(2)) RESULTS IN ABANDONMENT OF THE APPLICATION, IT WOULD BE BEST TO ALWAYS CHECK THE ABOVE BOX.

b. ☐ 37 CFR 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

Respectfully submitted,

  
Cynthia S. Murphy, Reg. No. 33,430

Direct all correspondence and telephone calls to:

Cynthia S. Murphy, Esq.  
RENNER, OTTO, BOISSELLE & SKLAR, LLP  
1621 Euclid Avenue, 19th Floor  
Cleveland, Ohio 44115  
Tel: 216-621-1113 Fax: 216-621-6165  
Internet: cmurphy@rennerotto.com

10/088842

JC10 Rec'd PCT/PTO 21 MAR 2002

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT application of:

Applicant: Giovanni Battista Zenga  
Appln. No.:  
Filing Date:  
Title: LAMINAR STRUCTURE  
Docket No.: DYOUP0227US

**PRELIMINARY AMENDMENT DELETING MULTIPLE DEPENDENCIES**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please amend the claims of this application in the below indicated manner.<sup>1</sup>

1. A laminar structure comprising a deposited metal, the structure having microholes extending between a first surface and a second surface thereof, each microhole having a wall which meets the first surface with a rounded edge or tapered configuration in such a manner that the first surface is substantially smooth.
2. A structure according to Claim 1, wherein the microholes have a diameter of less than 30  $\mu\text{m}$ .
3. A structure according to Claim 1, wherein the microholes have a diameter of less than 3-4  $\mu\text{m}$ .
4. A structure according to Claim 1, wherein the microholes have a polygonal or rhomboid form.
5. A medical device comprising, at least in part, a structure according to Claim 1, the structure having microholes formed therein which are at least sufficiently large to permit the passage of plasma, for example, therethrough.

---

1. The change(s) to the specification and/or claims are shown by underscoring and bracketing in the marked-up version attached hereto as an Appendix.

6. A medical device according to claim 5 in the form of a prosthetic hip joint, the hip joint having a leg portion comprising a spike and peg and a hip portion comprising a dish and a cap; wherein the spike and the cap comprise said laminar structure.

7. A medical device according to claim 5, wherein the laminar structure is formed as a cage, respective ends of the cage being securable either side of a break in a bone or to individual bones to promote regeneration of bone structure across said break or between said individual bones.

8. A medical device according to Claim 5, wherein the structure is of titanium.

9. A heat sink comprising a structure according to Claim 1, one end of said structure being capable of being affixed to a surface from which heat is to be conducted.

10. A heat sink according to claim 9, wherein the structure is of nickel, silver, gold, brass or titanium.

11. A filter element comprising a laminar structure according to Claim 1 formed as a tube.

12. A filter element according to claim 11, wherein the laminar structure is of nickel.

13. A filter element according to claim 11, wherein the laminar structure is arranged to facilitate cleaning of the filter element.

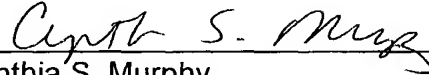
14. A method of forming a laminar structure according claim 1 comprising selectively depositing in a galvanic electroforming process a metal on a matrix arranged at the electroforming cathode to form said structure with a smooth surface formed with microholes meeting the first surface with a rounded or tapered configuration, the walls of said holes having rounded edges and diameters which formed in dependence upon the length of time the structure is placed in a galvanic bath used in said process and the desired thickness of the laminar structure.

15. A method according to claim 14, wherein the metal is nickel, gold, silver, brass or titanium.

**Remarks**

This amendment is being submitted to delete all multiple dependencies from the claims prior to calculation of the filing fee.

Respectfully submitted,



Cynthia S. Murphy

Reg. No. 33,430

RENNER, OTTO, BOISSELLE & SKLAR, LLP

1621 Euclid Avenue, 19th Floor

Cleveland, Ohio 44115

Tel: (216) 621-1113

Fax: (216) 621-6165

Email: cmurphy@RennerOtto.com

R:\CSM\DYOUNIP0227\IP0227US prelim amend wpd



## APPENDIX

The change(s) to the specification and/or claims are below shown by underscoring and bracketing.

### ***In the Claims:***

Claims 3-5, 8, 9, 11, 13 and 14 have been amended as follows:

3. (Amended) A structure according to Claim 1 [or 2], wherein the microholes have a diameter of less than 3-4  $\mu\text{m}$ .
4. (Amended) A structure according to [any preceding claim] Claim 1, wherein the microholes have a polygonal or rhomboid form.
5. (Amended) A medical device comprising, at least in part, a structure according to [any preceding claim] Claim 1, the structure having microholes formed therein which are at least sufficiently large to permit the passage of plasma, for example, therethrough.
8. (Amended) A medical device according to [any preceding claim] Claim 5, wherein the structure is of titanium.
9. (Amended) A heat sink comprising a structure according to [any of claims 1 to 4] Claim 1, one end of said structure being capable of being affixed to a surface from which heat is to be conducted.
11. (Amended) A filter element comprising a laminar structure according to [any of claims 1 to 4] Claim 1 formed as a tube.
13. (Amended) A filter element according to claim 11 [or 12], wherein the laminar structure is arranged to facilitate cleaning of the filter element.
14. (Amended) A method of forming a laminar structure according [to any of claims 1 to 4] claim 1 comprising selectively depositing in a galvanic electroforming process a metal on a matrix arranged at the electroforming cathode to form said structure with a smooth surface formed with microholes meeting the first surface with a rounded or tapered configuration, the walls of said holes having rounded edges and diameters which formed in dependence upon the length of time the structure is placed in a galvanic bath used in said process and the desired thickness of the laminar structure.

LAMINAR STRUCTURE

This invention relates to laminar structures. Preferred embodiments relate to laminar structures as filter elements, laminar structures as heat sinks, and laminar structures as medical devices.

As mentioned above, one embodiment of the present invention is concerned with filtering devices in general and, more particularly a filtering element for treating liquids, dusts and also gases. This aspect of the invention is useful for filtering liquids that contain material to be removed (for example lubricating and/or cooling liquids employed in mechanical processing), for filtering dusts in environments in general (especially industrial environments, such as steel works for example), and for processing exhaust gases from internal combustion engines of motor vehicles and, more particularly, oxidizing anhydrides present in these gases.

It would be desirable if the filtering element described above could be readily cleaned from time to time, should this prove necessary, thereby avoiding difficulties associated with clogging which might otherwise require the element to be replaced.

Another embodiment of the invention is concerned generally with heat sinks by means of which heat may be dissipated from machinery and the like. In such situations, it is advantageous for air, for example, to be able to flow cleanly through the heat sink with reduced disruption.

Another embodiment of the invention is concerned generally with medical devices, and in particular with orthopedic or orthodontic devices where it is preferred that the body of the patient, and in particular the bones of the patient, can bond with and secure the device in place.

In a first aspect, the invention provides a laminar structure comprising a deposited metal, the structure having microholes extending between a first surface and a second surface thereof, each microhole having a wall which meets the first surface with a rounded edge or tapered configuration in such a manner that the first surface is substantially smooth.

Other preferred features are set out in the appended claims.

In a preferred form, the laminar structure when used as a filtering element comprises a tubular and generally cylindrical body with a perforated wall intended to be crossed by a fluid to be filtered, essentially characterized in that the said wall presents a layer-like structure obtained by means of a controlled galvanic electroforming process with selective deposition of nickel on a matrix arranged at the cathode, the said layer-like structure having an outer surface which is smooth and devoid of roughness and being formed with micro-holes that have walls with rounded edges and diameters depending on the length of time in the galvanic bath and the desired-thickness of the laminar structure, preferably smaller than 30 micron.

When used for the filtering of liquids, the filtering element in accordance with the invention can be advantageously applied, possibly together with several other similar filtering elements, to constitute a self-cleansing filtering device.

Aspects of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a filtration system which incorporates a laminar structure as a filter element;

Figure 2 is a schematic view of a portion of the laminar structure during its production process;

Figure 3 is a schematic plan view in the direction of the arrow III of Figure 2.

Figure 4 is a schematic view of the laminar structure as a medical device; and

Figure 5 is a schematic view of the laminar structure as another type of medical device; and

Figure 6 is a schematic view of the laminar structure as a heat sink.

Figure 1 shows a filtering device 1 interposed between an inlet line I of a liquid to be filtered (for example, a cooling emulsion of oil and water used during the carrying out of a machining operation and which may contain shavings and other particles of material to be removed) and an outlet line O that the liquid, when filtered and cleansed of at least some of the particles it contained, crosses in order to be re-inserted in the cooling circuit.

The filtering device 1 comprises a closed shell 2 (which is normally metallic) that is provided with an inlet opening 3 in communication with the inlet line I and an outlet opening 4 in communication with the outlet line O.

The inlet opening 3 and the outlet opening 4 are associated with, respectively, the valves (which may be electrically operated valves for example) indicated schematically by the reference numbers 5 and 6, which make it possible for the openings 3 and 4 to be selectively opened and closed.

5        The shell 2, which is preferably of a circular cross-section, has a lower portion  
7 in the form of a funnel that converges onto a lower discharge opening 8 that is  
likewise controlled by a valve 9 (which may also be an electric valve).

The upper part of the shell 2 is closed by a selectively removable lid 10 on which there is mounted a pneumatic distribution device 11 that can be supplied with 10 pressurized air or other fluid gas from a source 12.

Reference number 13 indicates a flange that extends transversely inside the shell 2 and in contact with its upper extremity. The flange 13 divides the volume within the shell 2 into a first chamber 14 which corresponds roughly to the middle and lower portion of the shell 2, and a second chamber 15 that corresponds roughly to the upper portion of the shell 2.

The first chamber 14 communicates with the inlet opening 3, while the second chamber 15 communicates with the outlet opening 4.

The flange 13 which acts as a partition baffle within the shell 2 carries a plurality of filtering members 16, each of which comprises an elongate support in the form of a hollow, and therefore permeable, cylinder; one end, preferably the upper end, of which is connected in a watertight manner to the flange 13. The other, preferably the lower end, is closed and arranged as to be generally coincident with the lower funnel portion 7 of the shell. Within the first chamber 15 each of the filtering members 16 therefore extends downwards from the flange 13. The internal cavity of each of the said filtering members 16 communicates with the second chamber 15.

It will be understood, of course, that the positional phrases “upper”, “lower” and “downwards” relate solely to the orientation shown in Figure 1 and therefore should not be taken as implying any other positional or orientational limitation.

Each of the filtering members 16 is surrounded by an external filtering element  
30 17 (the laminar structure) that consists of a thin and flexible cylindrical sheath, which  
may also be slightly conical, and which is open at both ends (although it could be open  
at just one end).

As can be seen more readily in Figures 2 and 3, each filtering element 17 has a micro-perforated laminar or layer-like structure and is therefore porous, where the perforations, indicated by 17a, have a plan (or section) form (i.e. have a shape when in plan view) that may be polygonal, generally hexagonal, or rhomboidal and walls that have rounded surfaces and taper from the outer face of the layer towards the inner face. More generally, the micro-holes 17a may have a form that simply converges or simply diverges from the outer face to the inner face of the layer and may also be of a converging-diverging form. The said micro-holes 17a may have diameters depending on the length of time in the galvanic bath and the desired thickness of the structure. One has to do with dimensions that will normally be less than 60 microns, preferably less than 30 microns, and could be, for example, of the order of 3 - 4 microns. These diameter sizes may either be homogeneous or differ from one region to another, in accordance with appropriate optimization criteria.

It is, of course, possible to use filtering elements 17 in which the hole sizes have to be adapted to specific application requirements and are therefore different from the ones indicated hereinabove.

In general, the density of the micro-holes 17a may be comprised, for example, between 10 dots/mm and 2 dots/mm (i.e. 10 holes/mm and 2 holes/mm), while the thickness of the laminar structure may be of the order of 80 microns to 500 microns. The micro-perforated filtration lamina 17 is realized by means of a controlled galvanic electroforming process, with (in this embodiment) selective deposition of nickel on a matrix at the cathode, appropriately prepared for surface conditioning of the layer 17. In particular, the said matrix, generically indicated by the letter M, has a hollow imprint, sometimes referred to as an "inkpot", suitable for creating the conductive zones for the electroforming process and the zones rendered insulating by filling with dielectric resins that constitute the electroformed holes, and eventually leveled and chrome-plated. In this way the nickel formed on the matrix M during the electrogalvanization process becomes deposited in the surroundings of the imprints S, thus forming the micro-holes 17a. The surface of the layer 17 realized in this manner has its outer surface, i.e. the surface that during the formation process is turned towards the matrix perfectly smooth and devoid of all roughness.

Purely by way of example, in this embodiment the material employed for the depositing the nickel on the matrix at the cathode could have the following composition:

	- nickel sulphate	300 g/l
5	- nickel chloride	28 g/l
	- boric acid	50 g/l
	- MAGNUM/RT (BL 251) additive	1 ml/l
	- 1.3.6 naphthalenetrisulphonic acid trisodic salt	7 g/l

The operating conditions for the galvanization process, again purely by way of example, could be as follows:

	- temperature:	52 - 56°C
	- electrometric pH:	4.4 - 4.8
	- cathode movement:	obligatorily rotational
	- cathode rotation speed:	80 - 90 m/min
15	- filtration:	continuous, on activated carbon

As far as the number of the filtering members 16 and related filtering elements 17 in accordance with this embodiment of the invention is concerned, the choice will be made on the basis of the specific requirements of each particular application, since it is also possible, if appropriate, to use no more than a single filtering member 16.

Each filtering member 16 contains in a generally axial position a pneumatic duct 18 which is connected to a air distributor 11 and is provided with a series of air-blowing orifices arranged at different levels, each orifice being equipped with an appropriate valve not shown on the drawings. The Reference number 22 identifies an electronic unit that controls the functioning of the valves 5, 6 and 9, of the pressurised-air source 12 and a distributor 11 in such a manner as to produce an orderly sequence of filtering phases and cleaning phases of the device 1. In the embodiment here illustrated, switching between the two phases is controlled by the unit 22 as a function of the signal generated by a barometric sensor 23 that senses the fluid pressure gradient existing between the inlet opening 3 and the outlet opening 4, that is to say, the so-called loss of head of the fluid circuit through the filtering device 1.

During the filtering phase, the valve 9 is closed and the pressurized-air source 12 is deactivated. The valves 5 and 6, on the other hand, are maintained in their open

It should however be noted that whilst the invention has here been described with specific reference to a filtering device for lubricating and cooling liquids employed in machining operations, it can be applied in an equally advantageous

manner to a wide range of fluids, liquids and gases containing contaminating particles that have to be removed or, more generally, are to be treated. These fluids may include liquids of various kinds, air carrying atmospheric dust, and also the exhaust gases of internal combustion engines. In the latter case, however, the purification  
5 treatment of the gases does not solely consist of a filtration, but also of an oxidation of anhydrides present in the exhaust gases following the raising of their temperature during the passage through the micro-holes of the filtering element 17.

Of course, the filtering or - more generally - the treatment device that makes use of the filtering elements in accordance with the invention will have to be adapted  
10 to the particular requirements of these different applications (for example by adjusting the hole size or density), though in a generally conventional manner well within the capacity of a technician specialized in this area. It should also be noted that the cleansing system of the filtering device may likewise be different from the one here described and may be, for example, an ultrasonic system or, in the case of dusts, a  
15 simple shaking device. In the case of applications for the treatment of the exhaust gases of internal combustion engines, there is no need for a cleansing cycle, because the particulate matter retained by the filtering element in accordance with the invention will simply be released into the atmosphere for a spark ignition cycle and self-burnt in the case of a Diesel cycle.

20 As mentioned above, in the first embodiment of the invention the laminar structure is useful as a filter element. In a second embodiment of the invention, as will now be described with reference to Figures 4 and 5, the laminar structure of the invention may also be useful in medical devices. In these embodiments, it is preferred that the laminar structure comprises titanium.

25 Figure 4 is a schematic view of a prosthetic hip joint which is commonly used for replacement of hip joints that have degraded, for example as a result of osteoporosis.

The joint 30 comprises a leg portion 32 and a hip portion 34. The leg portion 32 comprises a spike 34 which is designed to be driven into the femur of a patient, and  
30 a peg 36 which is receivable in the hip portion and which is designed to act as a pivot point about which the patient's leg can move.



As shown, the spike 34 is formed at least partly of the laminar structure used in the first embodiment and may have similar features to those described above. The peg 36 (in contrast to the spike) is not formed of a laminar structure as hereinbefore described, but is instead solid and of a metal or alloy so that the peg generally has a greater mechanical strength than the spike.

The hip portion comprises a dish 38 which acts as a surface on which the peg can bear during movement of the spike (which naturally occurs as the leg in which the spike is inserted is moved), and is covered by a cap 40 which is formed of the above described laminar structure.

Advantageously, the holes in the laminar structure of the spike 34 and cap 40 are such that plasma, for example, can flow therethrough to allow bodily material, such as tissue or bone for example, to grow into the spike and the cap thereby securing the spike and cap in place.

Similarly, Figure 5 shows an orthodontic device which could be implanted in a patient who has experienced a broken jaw, for example, so that tissue or bone surrounding the device can grow into the device as the broken jaw mends. As will be appreciated, the device provides support whilst the broken bone is mending, and also acts as a means for strengthening the mended bone.

In addition to being used as an orthodontic device, it will be apparent that the laminar structure could also be used to overlie a break in a patient's radius or ulna, for example, or any other bone. Effectively, the laminar structure acts to support the bone whilst healing and also acts as a means for strengthening the break after healing has occurred. The laminar structure could be secured to the bones either side of a break to stabilise the break and to assist the mending of the break that naturally occurs.

Figure 6 is an elevational view of a third embodiment of the invention, where the laminar structure 17 is used as a heat sink. In this embodiment, it is preferred that the laminar structure is of a good heat conductor such as nickel, titanium, silver, gold or brass.

As shown in Figure 6, the laminar structure is attached to a surface 50 which will be or is warm or hot. The surface 50 could, for example, be a housing for a piece of electronic equipment such as a microprocessor, or a housing for another mechanical and/or electrical device. The laminar structure serves to conduct heat away from the

surface 50, and the holes formed in the structure allow air to flow through the structure to further improve the heat dissipating effect of the structure.

It will be appreciated from the above that as the outer surface of the laminar structure is smooth and devoid of roughness and is formed with micro-holes that have walls with rounded edge, it is particularly well suited for use in medical devices since the likelihood of rough edges which could cause internal injuries is reduced. Furthermore, as the structure is substantially smooth it is easier to clean. The smooth nature of the structure is also advantageous when used as a heat sink since the smooth surface is less likely to resist air flow thereover and/or therethrough.

It will be apparent from the above, that one embodiment of the invention provides a laminated structure, manufactured to the desired form with perforated walls which can dissipate heat when machines operate at high temperatures is obtained by a galvanic electro-forming process with deposition of nickel or titanium or silver or gold or brass on a matrix (M) arranged at the cathode. It is designed superficially with micro-incisions until the desired micro-perforations are position where desired, at the diameter desired and at the thickness requested for a correctly calculated wall thickness.

Another embodiment of the invention provides a laminated structure, manufactured to the desired form with perforated walls which is designed to be used for the mending of bones for the medical sector in orthopedics and/or orthodontics is obtained by a galvanic electro-forming process with deposition of titanium on a matrix (M) arranged at the cathode. It is designed superficially with micro-incisions until the desired microperforations are positioned where desired, at the diameter desired which can be linked to the diameter of plasma cells to nourish the bone material being reconstructed.

In another arrangement, the laminar structure can be formed or constructed as a cage and secured at either end to a bone or parts of the same bone. As a result of the microholes in the structure, blood can flow therethrough to enable the bones to regenerate themselves.

Naturally, the construction details and the embodiments described above may be varied with respect to what has here been described and illustrated without

disserting from the spirit and the scope of the present: invention as set out in the claims that follow.

CLAIMS

1. A laminar structure comprising a deposited metal, the structure having microholes extending between a first surface and a second surface thereof, each microhole having a wall which meets the first surface with a rounded edge or tapered configuration in such a manner that the first surface is substantially smooth.  
5
2. A structure according to Claim 1, wherein the microholes have a diameter of less than 30  $\mu\text{m}$ .
- 10 3. A structure according to Claim 1 or 2, wherein the microholes have a diameter of less than 3-4  $\mu\text{m}$ .
4. A structure according to any preceding claim, wherein the microholes have a polygonal or rhomboid form.  
15
5. A medical device comprising, at least in part, a structure according to any preceding claim, the structure having microholes formed therein which are at least sufficiently large to permit the passage of plasma, for example, therethrough.
- 20 6. A medical device according to claim 5 in the form of a prosthetic hip joint, the hip joint having a leg portion comprising a spike and peg and a hip portion comprising a dish and a cap; wherein the spike and the cap comprise said laminar structure.
7. A medical device according to claim 5, wherein the laminar structure is formed as a cage, respective ends of the cage being securable either side of a break in a bone or to individual bones to promote regeneration of bone structure across said break or between said individual bones.  
25
8. A medical device according to any preceding claim, wherein the structure is of titanium.  
30

9. A heat sink comprising a structure according to any of claims 1 to 4, one end of said structure being capable of being affixed to a surface from which heat is to be conducted.

5 10. A heat sink according to claim 9, wherein the structure is of nickel, silver, gold, brass or titanium.

11. A filter element comprising a laminar structure according to any of claims 1 to 4 formed as a tube.

10

12. A filter element according to claim 11, wherein the laminar structure is of nickel.

13. A filter element according to claim 11 or 12, wherein the laminar structure is  
15 arranged to facilitate cleaning of the filter element.

14. A method of forming a laminar structure according to any of claims 1 to 4 comprising selectively depositing in a galvanic electroforming process a metal on a matrix arranged at the electroforming cathode to form said structure with a smooth  
20 surface formed with microholes meeting the first surface with a rounded or tapered configuration, the walls of said holes having rounded edges and diameters which formed in dependence upon the length of time the structure is placed in a galvanic bath used in said process and the desired thickness of the laminar structure.

25 15. A method according to claim 14, wherein the metal is nickel, gold, silver, brass or titanium.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number  
**WO 01/21282 A2**

(51) International Patent Classification<sup>7</sup>: **B01D 39/00**

(21) International Application Number: **PCT/IB00/01419**

(22) International Filing Date:  
22 September 2000 (22.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
9922451.1 22 September 1999 (22.09.1999) GB

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*):  
**VIOSTYLE LIMITED [CY/CY]**; Margarita House,  
15 Therm. Dervis Avenue, CY-1309 Nicosia (CY).

**Published:**  
— *Without international search report and to be republished upon receipt of that report.*

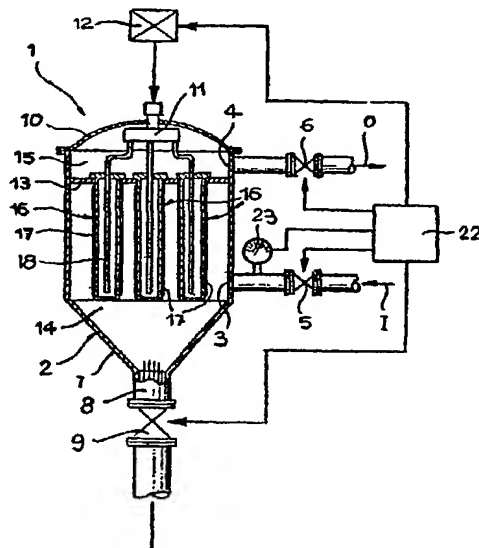
(72) Inventor; and

(75) Inventor/Applicant (*for US only*): **ZENGA, Giovanni, Battista [IT/IT]**; Villa Lovera, 5/2, I-10025 Pino Torinese (IT).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(74) Agents: **NACHSHEN, Neil, Jacob et al.**; D. Young & Co.,  
21 New Fetter Lane, London EC4A 1DA (GB).

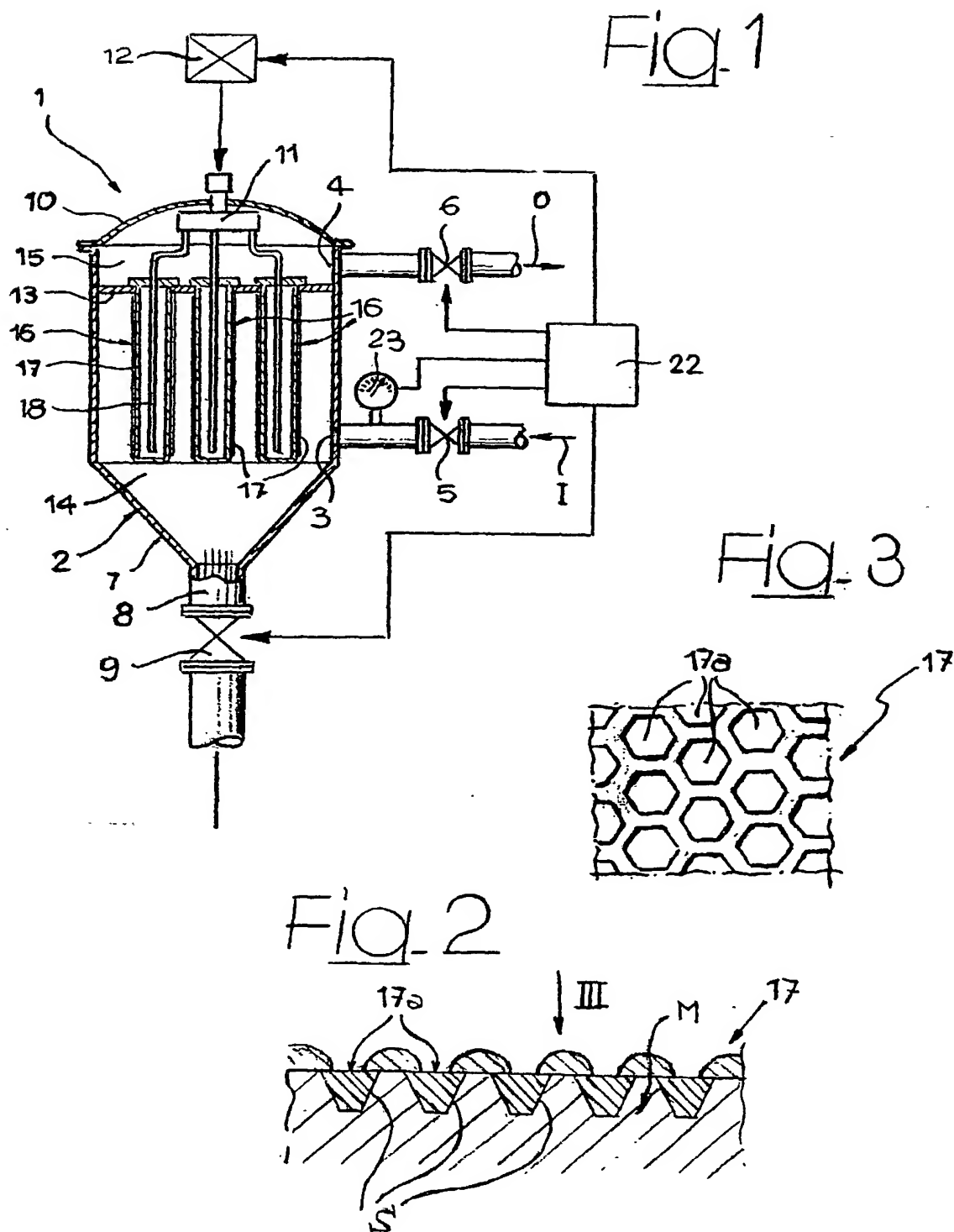
(54) Title: **LAMINAR STRUCTURE**

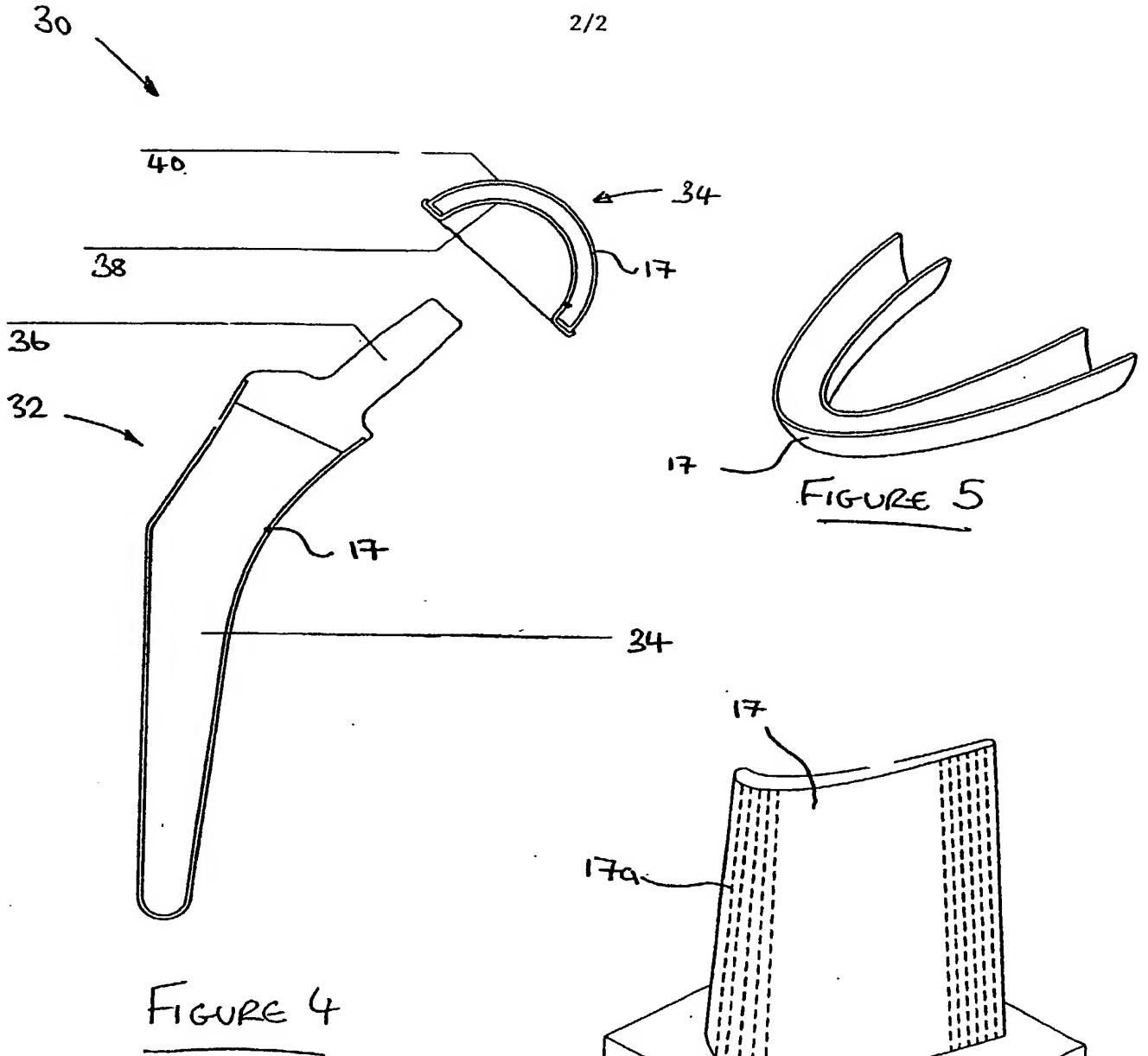


(57) Abstract: A laminar structure (17) comprising a deposited metal, the structure having microholes (17a) extending between a first surface and a second surface thereof, each microhole having a wall which meets the first surface with a rounded edge or tapered configuration in such a manner that the first surface is substantially smooth.

WO 01/21282 A2

1/2







RENNER, OTTO, BOISSELLE & SKLAR

Attorney Docket No. DYOUN0227US

**PATENT (OUS)**

**COMBINED DECLARATION AND POWER OF ATTORNEY**  
(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT)

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: LAMINAR STRUCTURE

the specification of which

☐ is attached hereto, or

☒ was filed as United States  
Application or PCT International  
Application (give Express Mail label  
number and deposit date if  
Application number not yet known):

Application No.:

(Express Mail Label No.) EF232848059US

Filing Date:

(Deposit Date) March 21, 2002

Amended on (if applicable):

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56(a).

**PRIORITY CLAIM**

I hereby claim priority benefits under Title 35, United States Code, §119 of (i) any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed; and (ii) any United States provisional application(s) that is/are listed below.

☐ no such applications have been filed.

☒ such applications have been filed as follows.

**EARLIEST FOREIGN/PROVISIONAL APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED	
			Yes	No
GB	9922451.1	22 September 1999	X	

**ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS  
(6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION**

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Armand P. Boisselle, Reg. No. 22,381; Warren A. Sklar, Reg. No. 26,373;  
Don W. Bulson, Reg. No. 28,192; Cynthia S. Murphy, Reg. No. 33,430.

The undersigned to this declaration and power of attorney hereby authorizes the U.S. attorney(s) named herein to accept and follow instructions from

Authorized representative: D. Young & Co., Briton House, Briton Street, Southampton SO14 3EB, United Kingdom

as to any actions to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney(s) and the undersigned. In the event of a change in the person(s) from whom instructions may be taken, the U.S. attorney(s) will be so notified by the undersigned.

Send Correspondence To

Cynthia S. Murphy, Esq.  
Renner, Otto, Boisselle & Sklar, LLP  
1621 Euclid Ave., 19th Floor  
Cleveland, Ohio 44115

Direct Telephone Calls To:

(name and telephone number)

Cynthia S. Murphy

(216) 621-1113

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole or First Inventor: Giovanni Battista Zenga			
Inventor's signature:	<i>G. Zenga</i>	Date:	24/04/2002
Residence: (City & State/Country):	Same as Post Office Address	Citizenship:	Italy
Post Office Address:	Villa Lovera 5/2 10025 Pino Torinese ITALY ITX		

Full Name of Additional Joint Inventor (if any):			
Inventor's signature:		Date:	
Residence: (City & State/Country):	Same as Post Office Address	Citizenship:	
Post Office Address:			

CHECK FOR ANY OF THE FOLLOWING ADDED PAGE(S) WHICH FORM A PART OF THIS DECLARATION

- ☐ Signature for additional joint inventors.
- ☐ Added page to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (CIP) application.
- ☒ This declaration ends with this page.